

FEBRUARY 27, 1922

AVIATION

VOL. XII. NO. 9

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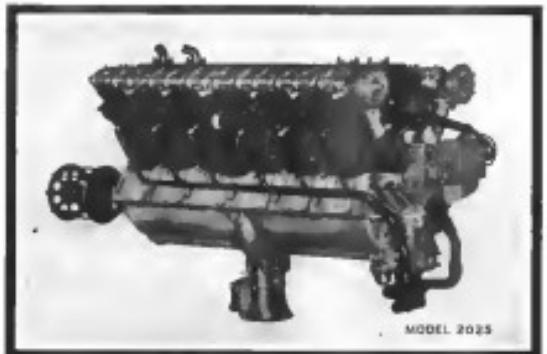
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Vol. 231

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No. 8

AVIATION

LAWRENCE ST. CLAIR
Editor
V. E. CLARK
Edward P. WARREN
RALPH H. TURNER
CONTRIBUTING EDITORS

Heroes of Peace

PACIFIC brings a return to normal in all military and naval operations except in the air service. It is true that

The heroes are not confined to warlike. New development is tremendous and one of the inevitable results of progress is to be seen in the self-sacrifice of those who made their last flight with the British.

The sons of the United States will always continue pages of brilliant achievements at her sons in the air. These are not confined to warlike alone. Our early pioneers of flight made their lives willingly in advancing their chosen art. It will ever be so with the men who rise into the heavens and add their part to the world's knowledge. Those brave comrades of the air who have lost their lives in the drama created have gained the glory that comes from having given their all in the advancement of our country's national security.

They were our friends. We look pride in their achievements and success. We now know our heads in sorrow over their supreme and sacrifice in that the greatest of all tragedies of our heroes.

Aeronautical Research and Experimentation

THE recent bombing tests of the Virginia Capes were completed, confirming evidence of the tremendous possibilities of the airplane as a military weapon. It is believed that the aggressiveness of the several powers in their aerial programs can be directly traced in the results of these bombing tests.

Yet aerial warfare was in existence. For example, the recent bombing tests were carried on under 4000 ft altitude with what was known to be comparatively crude bomb sights. Until recently the highest altitude that these bombing aeroplanes—the Martin Bombers—could reach was 8000 or 10,000 ft. Where at daytime bombing they would have been visible from the ground and subject to anti-aircraft fire. Since these tests the supercharger principle has been applied to the Martin Bomber and they have flown that airplane to an altitude of 27,000 ft—the highest point ever reached by a multi-motored airplane of this size.

The tremendous importance to the country of this fundamental research work which has been so successfully carried on at McCook Field can not be over estimated.

Now that our bombing planes can fly above 25,000 ft and there be completely invisible from the ground and therefore safe from anti-aircraft fire, it remains for the Air Service Engineers to solve the problem of developing a bomb sight which will make it possible to do accurate and certain bombing from this tremendous altitude. Certainly planes have been developed for gun to shoot at this range. No one can picture the possibility of developing a bomb sight that will do this same thing.

The people of this country are concerned of the importance

of the military and commercial development of the airplane. Congress should recognize the work that has been done by the Air Service and the paramount importance to this country of holding together the efficient research organization now in existence at McCook Field and allow the proper funds to continue to carry on this important work.

What is a Subsidy?

THERE is a popular belief that the genius of the American people is inexplicably opposed to subsidies to any particular industry, but there is nothing in the past history of the United States to indicate that such is the case. The protective tariff is nothing but a subsidy, every exchange is a subsidy, and even aside from those industrial grants there has been frequent legislation on the part to assist railroads, the merchant marine and other enterprises judged to be essential to the public welfare. A particularly notable instance is the allotment of enormous amounts of the public domain to the so-called land-grant railroads in the early days of the opening up of the West.

The most fundamental objection to a subsidy seems to arise from the present feeling that any move in the direction of subsidization of any industry causes an expenditure of unneeded wealth, the appropriation of sums large even in these days of huge governmental budgets. That feeling, however, in the case of aircraft, like the belief as to the absence of subsidies in the past, is not founded on facts. The subsidy expenditures of European nations which grant governmental assistance to enterprises applying continental permits are extraordinarily small, and it is astonishing to see how much can be done with a moderate appropriation. The British government, for example, expended on behalf of civil aviation during the last complete fiscal year only £250,000 (\$500,000). The French Republic allotted to airplane subsidies in the same period £1,000,000 francs (\$250,000) and this sum was sufficient, as well known, to keep busy operating between Paris and London, Paris and Brussels, Paris and Warsaw, Bordeaux and Southampton, Marseilles and Montpellier, and Toulouse and Castres, in addition to several shorter or intermediate routes. The Deutsche Luftreederei received a subsidy from the formerly independent German government of approximately \$1,000,000 dollars, or \$300,000 at the rate of exchange then existing, and ran lines all over Germany as a result.

A subsidy policy due the United States may be wise or unwise, but it should not be dismissed as involving vast expenditures, as practically every nation in Europe has made no subdivision of one sort or another and so it is evident from that fact and from the statistics enumerated above that the financial burden is not really so crushing as a superficial inspection might lead one to suppose. Indeed, the expenditure is almost insignificant on the scale by which governmental expenditures are habitually measured at the present time.

The total ground unassisted required for these systems with and without the emergency runway system would be roughly as follows:

New York-Chicago
Distance: 1,000 miles
Average speed: 400 mph
Total of flights: 10 per hour
Average time: 1 hr 20 min per flight
Total of flights: 10 per hour
Total of resources: 1,000 total crew hours per year
Hours due to use of resources: 12,000 per year

New York-Boston
Distance: 300 miles
Average speed: 400 mph
Total of flights: 10 per hour
Average time: 1 hr 10 min per flight
Total of flights: 10 per hour
Total of resources: 1,000 total crew hours per year
Hours due to use of resources: 12,000 per year

New York-Chicago and New York-Boston
Distance: 1,300 miles
Average speed: 400 mph
Total of flights: 10 per hour
Average time: 1 hr 40 min per flight
Total of flights: 10 per hour
Total of resources: 1,000 total crew hours per year
Hours due to use of resources: 12,000 per year

Cost of Resources

These increases are substantially of importance and so far completely considered. At the same time it should be kept in mind that the development of the systems and associated infrastructure must continue. For other cities were tapped would add additional training facilities. A new city type was suggested and showed that the addition cost due to the use of runways dropped below 10 per cent. Also it is extremely possible anyhow to operate over most of the distances shown on Fig. 3 without some intermediate fields and such fields would cost more than the proposed system of runways if they were



Fig. 3. Map showing proposed New York-Chicago and New York-Boston City air routes.

to be fully supported. Taking all in all it would appear most probable that the increase of even 12 to 15 per cent would be fully justified by the division from studies of machines with consequent injuries to pilots and damage to freight not to mention the elimination of losses due to damages by the owners of property suspended over forced landings. These ground investigation figures are large but the feasibility of gas jet service seems to be a matter of common sense construction to any man a condition which is not entirely fully appreciated.

The proposed emergency system has another very important advantage. It makes night flying both safe and practical. Each station field and emergency runway can be provided with a beam consisting of a searchlight pivoted vertically the light of which the pilot uses as his guide from runway to runway along the route. Each runway and field would be equipped with flood lights or the airplane equipped with

strobe lights for use in offering night landings. On the whole the proposed system certainly appears the most promising for a rapid commercial service.

We have now come to the point where we discuss the question of field sites and associated user resources on the possible serving of towns by the use of airplanes as far as is concerned.

The accompanying table is of interest in showing the saving of time by using airplanes over the routes considered. In computing at one-half hour has been allowed for time traversing in and from fields at each end and one-half hour lost time has been allowed for each stop. The last section gives the total time required for the trip, including, however, the direct distance traveled by the trip. Required time is very conservative when only the proposed mileage is considered.

TABLE I. AIR AND CAR TIME

New York-Boston		New York-Chicago		Boston-Chicago	
From	To	From	To	From	To
New York	Boston	4:00	4:40	4:00	5:00
New York	Chicago	5:10	6:50	5:10	6:50
New York	Washington	5:10	6:50	5:10	6:50
New York	Atlanta	5:10	6:50	5:10	6:50
New York	St. Louis	5:10	6:50	5:10	6:50
New York	Minneapolis	5:10	6:50	5:10	6:50
New York	Seattle	5:10	6:50	5:10	6:50
New York	Portland	5:10	6:50	5:10	6:50
New York	Los Angeles	5:10	6:50	5:10	6:50
New York	Honolulu	5:10	6:50	5:10	6:50
New York	Albuquerque	5:10	6:50	5:10	6:50
New York	Phoenix	5:10	6:50	5:10	6:50
New York	Tampa	5:10	6:50	5:10	6:50
New York	Miami	5:10	6:50	5:10	6:50
New York	San Juan	5:10	6:50	5:10	6:50
New York	Montreal	5:10	6:50	5:10	6:50
New York	Toronto	5:10	6:50	5:10	6:50
New York	Vancouver	5:10	6:50	5:10	6:50
New York	Sydney	5:10	6:50	5:10	6:50
New York	London	5:10	6:50	5:10	6:50
New York	Paris	5:10	6:50	5:10	6:50
New York	Rome	5:10	6:50	5:10	6:50
New York	Teheran	5:10	6:50	5:10	6:50
New York	Aden	5:10	6:50	5:10	6:50
New York	Perth	5:10	6:50	5:10	6:50
New York	Singapore	5:10	6:50	5:10	6:50
New York	Kuala Lumpur	5:10	6:50	5:10	6:50
New York	Colombo	5:10	6:50	5:10	6:50
New York	Delhi	5:10	6:50	5:10	6:50
New York	Moscow	5:10	6:50	5:10	6:50
New York	Beijing	5:10	6:50	5:10	6:50
New York	Hanoi	5:10	6:50	5:10	6:50
New York	Pyongyang	5:10	6:50	5:10	6:50
New York	Seoul	5:10	6:50	5:10	6:50
New York	Tokyo	5:10	6:50	5:10	6:50
New York	Osaka	5:10	6:50	5:10	6:50
New York	Chiba	5:10	6:50	5:10	6:50
New York	Manila	5:10	6:50	5:10	6:50
New York	Singapore	5:10	6:50	5:10	6:50
New York	Perth	5:10	6:50	5:10	6:50
New York	Sydney	5:10	6:50	5:10	6:50
New York	Adelaide	5:10	6:50	5:10	6:50
New York	Perth	5:10	6:50	5:10	6:50
New York	Singapore	5:10	6:50	5:10	6:50
New York	Perth	5:10	6:50	5:10	6:50
New York	Sydney	5:10	6:50	5:10	6:50
New York	Adelaide	5:10	6:50	5:10	6:50
New York	Perth	5:10	6:50	5:10	6:50
New York	Singapore	5:10	6:50	5:10	6:50
New York	Perth	5:10	6:50	5:10	6:50
New York	Sydney	5:10	6:50	5:10	6:50
New York	Adelaide	5:10	6:50	5:10	6:50
New York	Perth	5:10	6:50	5:10	6:50
New York	Singapore	5:10	6:50	5:10	6:50
New York	Perth	5:10	6:50	5:10	6:50
New York	Sydney	5:10	6:50	5:10	6:50
New York	Adelaide	5:10	6:50	5:10	6:50
New York	Perth	5:10	6:50	5:10	6:50
New York	Singapore	5:10	6:50	5:10	6:50
New York	Perth	5:10	6:50	5:10	6:50
New York	Sydney	5:10	6:50	5:10	6:50
New York	Adelaide	5:10	6:50	5:10	6:50
New York	Perth	5:10	6:50	5:10	6:50
New York	Singapore	5:10	6:50	5:10	6:50
New York	Perth	5:10	6:50	5:10	6:50
New York	Sydney	5:10	6:50	5:10	6:50
New York	Adelaide	5:10	6:50	5:10	6:50
New York	Perth	5:10	6:50	5:10	6:50
New York	Singapore	5:10	6:50	5:10	6:50
New York	Perth	5:10	6:50	5:10	6:50
New York	Sydney	5:10	6:50	5:10	6:50
New York	Adelaide	5:10	6:50	5:10	6:50
New York	Perth	5:10	6:50	5:10	6:50
New York	Singapore	5:10	6:50	5:10	6:50
New York	Perth	5:10	6:50	5:10	6:50
New York	Sydney	5:10	6:50	5:10	6:50
New York	Adelaide	5:10	6:50	5:10	6:50
New York	Perth	5:10	6:50	5:10	6:50
New York	Singapore	5:10	6:50	5:10	6:50
New York	Perth	5:10	6:50	5:10	6:50
New York	Sydney	5:10	6:50	5:10	6:50
New York	Adelaide	5:10	6:50	5:10	6:50
New York	Perth	5:10	6:50	5:10	6:50
New York	Singapore	5:10	6:50	5:10	6:50
New York	Perth	5:10	6:50	5:10	6:50
New York	Sydney	5:10	6:50	5:10	6:50
New York	Adelaide	5:10	6:50	5:10	6:50
New York	Perth	5:10	6:50	5:10	6:50
New York	Singapore	5:10	6:50	5:10	6:50
New York	Perth	5:10	6:50	5:10	6:50
New York	Sydney	5:10	6:50	5:10	6:50
New York	Adelaide	5:10	6:50	5:10	6:50
New York	Perth	5:10	6:50	5:10	6:50
New York	Singapore	5:10	6:50	5:10	6:50
New York	Perth	5:10	6:50	5:10	6:50
New York	Sydney	5:10	6:50	5:10	6:50
New York	Adelaide	5:10	6:50	5:10	6:50
New York	Perth	5:10	6:50	5:10	6:50
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New York	Singapore	5:10	6:50	5:10	6:50
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New York	Perth	5:10	6:50	5:10	6:50
New York	Singapore	5:10	6:50	5:10	6:50
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New York	Adelaide	5:10	6:50	5:10	6:50
New York	Perth	5:10	6:50	5:10	6:50
New York	Singapore	5:10	6:50	5:10	6:50
New York	Perth	5:10	6:50	5:10	6:50
New York	Sydney	5:10	6:50	5:10	6:50
New York	Adelaide	5:10	6:50	5:10	6:50
New York	Perth	5:10	6:50	5:10	6:50
New York	Singapore	5:10	6:50	5:10	6:50
New York	Perth	5:10	6:50	5:10	6:50
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New York	Singapore	5:10	6:50	5:10	6:50
New York	Perth	5:10	6:50	5:10	6:50
New York	Sydney	5:10	6:50	5:10	6:50
New York	Adelaide	5:10	6:50	5:10	6:50
New York	Perth	5:10	6:50	5:10	6:50
New York	Singapore	5:10	6:50	5:10	6:50
New York	Perth	5:10	6:50	5:10	6:50
New York	Sydney	5:10	6:50	5:10	6:50
New York	Adelaide	5:10	6:50	5:10	6:50
New York	Perth	5:10	6:50	5:10	6:50
New York	Singapore	5:10	6:50	5:10	6:50
New York	Perth	5:10	6:50	5:10	

Methods of Air Navigation

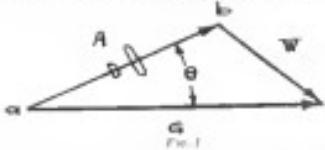
Formulas and Instruments for Checking Dead Reckoning Described
By Herbert F. Thader

The second, or air navigation has not until quite recently given a general degree of satisfaction, owing to the fact that the best forms were in real demand as methods for methods of tree air navigation. For the most part short flights, which were made over land by the method of piloting, in which the animals follow a route between two places by its ability to recognize the intermediate features from a map, adopted for all purposes requirements. But when the scope of long-distance flights became a reality and not merely a hypothetical possibility, when the Atlantic was spanned, and when many more long distances had to be covered and many more difficulties encountered, there was a tendency still the need of methods by which the could utilize his position other than by the recognition of terrestrial features. In the following paragraphs a few of the instruments and methods devised to attain this will be described.

The first and most important of all measurements is that of "blood reducing". All other methods can simply measure to this use and we used ours in the usual manner. The method is itself extremely simple, involving merely glazing in scale on a ratio, the small droplets of blood being measured by the number of drops required.

"Blood grade" is the actual ground covered and advanced against the speed of the test plus or minus the effect of any existing wind. The deviating influence of the wind are the most important factor with which to calculate the speed and it is necessary to be able to determine their effect. This may be done in all cases during a flight. In this trial, there was a number of methods by which this can be done, with considerable accuracy.

Assuming it result to be under the influence of two velocities its own and that of the wind, then the resultant velocity will be the vector sum of these two quantities. As shown in Fig. 111, if v is the craft's velocity (air speed), w is the wind



10

velocity, and/or as the resistance velocity (dragged sand speed). The ground, as is observed in the drift, is not moving at a uniformly parallel to the bubble-line (horizontal) and left (or right) but is apparently moving with a direction to measured and passing through a point in a direction angle to the horizontal. The Vortex angle, as measured in degrees angle in the St. Louis Bearing Plates shown in Fig. 10. The instrument consists of an annular ring graduated into quadrants and degrees like a compass card. A number of horizontal parallel wires are stretched across the open center hole of the annular ring. The wires are spaced at intervals of 1/4 turn and are graduated in hundreds of feet, as in the protractor head. As seen in the photograph as a drift angle increases, the ground as observed directly before the craft through the open center. The annular ring is turned until

The horizontal wings are parallel to the apparent line of motion of the ground object. The angle θ indicated between the wires and axis of the instrument is the drift angle, and if this angle is applied to the compass course steered, it will give the course made good over the ground.

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ce onto ground object at the line of the robot hand, by means of the two parallel lines the forward hand. With a step shift the time is varied from when the forward hand was able until the craft passes vertically over the same object, as indicated by the end-point object side slingshot with the reverse and the end-point control side slingshot with the ground. The ground coverage depends on the distance between the two objects and the distance represents a half step of the ground. Dividing this last greatest distance by the observed range of gestures gives the ground speed. This method is only applicable at relatively low altitudes 2000 m to 4000 m, because the errors involved in calculating the ground object become proportionally greater with altitude and hence

A more reliable method of distinguishing the drift angle, other than by observing vertically below the drift in to measure the horizontal angle of an object from the laboratory when moving after the drift has passed, directly compares the object. To take a back sight, an observer stands at the tail end of the drift and looks through the telescope of the instrument to observe the red rod and pole of the staff. The back sight angle as well as other features are measured and in the Wind Drift Bearing Plate shown in Fig. 21 the numbers 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 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A drift hole may be entered in the bottom plate; it comprises a central hole with tapered end tapers, and a bevelled edge for drawing drift lines in the bottom plate glass. The drift hole is at the same height as the top of the glass, so that the drift lines will be at the same level as the water surface.

The position of that end is adjusted by turning the handle (18) until the index points to the true air speed on the scale (23). The end carries a graduated dial scale (24) over the top of the drift hole, and a scale (25) which indicates the range of drift speeds. The dial scale (24) is hinged at its base end, when, after

The method in the present photo is, while flying on a straight course, the camera is held flat so that the map is oriented to the left. The camera is held at an angle to the true air speed. A deflection angle is measured from the true air speed. A deflection angle is measured previously passed over (determining the drift angle) and a



Fig. 2. Army Surveying Plate, Fig. 3. Wind Gage Surveying Plate.

The drift angle and the wind vector are known. The closing side of the diagram is the wind vector.

This method of determining the wind velocity while perfectly possible has the disadvantage that quite a number of operations are necessary, some of which are subject to errors. The altitude of the craft, for example, should be known in order to obtain the ground speed over land under certain conditions. In error in the estimate of wind force will affect the altitude of the instrument readings adjusted to the changes in the atmospheric pressure as the craft progresses; this will introduce errors, owing to the changing altitude of the ground passed over. Other errors which are likely to affect the result are increased errors in taking the passage of the ground as the instrument moves across the surface.

2

After three or more drift lines have been observed at a height similar to that of a star, hence the name "Wind Star Plot". The method gives very good results at any altitude, besides the distance can be as great as desired. The method can also be applied to determine the position of stations, for example, determine the winds at the various altitudes, its direction vs. us., when a continuous layer of clouds always obscures the ground. Even then a fairly good analysis of the wind above the clouds can be made by determining the angle of the wind from the vertical, and the distance between them, when these factors determine the angle relative to the clouds (determining cloud patches or spots). A series of three or four observations give a good ac-

Foreign News

France

It is reported that among the extensions planned by French air lines companies during the coming year is that by the Compagnie Messageries Aériennes of their London-Paris service to Marseilles. At present Paris is not linked up by air to the south of France, travelers having to proceed to Toulouse by train. If the new line is established it should make a very considerable reduction in the time taken to get to the Riviera via Marseilles. It may also link up with the Latécoère lines to Morocco.

Great Britain

Tests of fuel tanks entered for the Air Ministry competition for safety tanks for aircraft commenced at the Royal Aircraft Establishment, Farnborough, on Dec. 5, and will continue thereon alternate days until the tests have been completed. The object of the competition, for which prizes amounting to £2,000 are being offered, to obtain, if possible, a tank which will withstand the shock to which it may be subjected in an airplane crash without either bursting or leaking, and thus eliminate almost entirely the possibility of fire in such circumstances, and which will also withstand the effect of enemy action by machine gun and shell fire. Improvements in design and inspection have already practically removed the danger of fire from internal causes during flight, and the satisfactory solution of the present problems will mean further substantial progress. The competition which, owing to its importance, was thrown open to all the world, has brought in twenty-six entries—nineteen from Great Britain, three from France, and one each from America, Belgium, Italy and Japan. Three prizes will be awarded, the first being £1,400, the second £400 and the third £200.

An experiment was recently carried out at Farnborough by the staff of the Royal Aircraft Establishment to discover if a parachute would ensure safety to an airplane pilot in the event of a spinning nose dive. A Camel biplane was detached, nose downward, from an observation balloon at a height of some 2,000 ft., and when half-way to the ground a weight bearing a parachute broke away from the plane. The altitude apparently was not enough, for the parachute did not expand until it had nearly reached the ground, and it landed with some violence. Further experiments are to be tried under slightly different conditions.

Spain

The Spanish Air Traffic Co. of Madrid has bought two Fokker airplanes of the latest type. These will be put into regular service on an air line between Seville, Spain, and El Arish (Larache) Morocco. The distance between these points is 170 miles and includes the crossing of the Strait of Gibraltar. This line, which also carries Spanish mails, was recently opened with much ceremony, including a blessing of the machines by the Bishop of Seville.

Argentina

The Ministry of War has ordered that on each landing field belonging to the Government and under said Ministry, a visual signal is to be painted consisting of one, two or three capitals placed in the center of the field. The upper part of these capital letters will face the north. The letters will be painted as if each one was surrounded by the lines of a rectangle of 20 by 10 m. Each letter will have a width of 3 m.

The military airfields will have a horizontal band three meters in width on the lower part of the letters right across the same. The letters may be made either out of brick, wood, or any other material, and should be laid in the ground so that they will not mean the slightest obstacle for the taxiing of the airplanes; also they will be whitened with lime, in order to be able to distinguish them from high up.

Civil airplanes will not be allowed to land on fields where military airfields are located without previous authorization or, in case of serious trouble, when permission will be requested from the air by given signs.



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